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PENSOFT

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Stenotanais (Crustacea, Tanaidacea) from the Santos Basin: the first described species of the family Akanthophoreidae off the Brazilian coast

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Abstract

Benthic samples collected from depths ranging between 686 and 2410 m along the Brazilian continental upper slope from Rio de Janeiro State to Santa Catarina State (23°S to 27°S) yielded a wealth of tanaidacean material, including two new species of *Stenotanais*. This is the first described species of the family Akanthophoreidae from Brazilian waters. *Stenotanais leonardoi* **sp. nov.** has a combination of unique characters including the uropod basal article longer than the pleotelson and the exopod somewhat wider than the endopod, longer than the endopod article-1 (0.7 times endopod length) and supporting two flat and wide terminal setae. *Stenotanais uropedon* **sp. nov.** is recognisable by its oar-shaped uropod endopod, with article-2 large, broad and flattened and the short exopod, only 0.3 times the endopod length. An identification key to the species of *Stenotanais* is given. These two species bring the total number of described akanthophoreids to 56 species and that of all tanaidaceans in Brazilian waters to 66 species.

Key Words

continental margin, Peracarida, south-western Atlantic, Tanaidomorpha, taxonomy, upper slope

Introduction

The family Akanthophoreidae Sieg, 1986 currently includes 54 species classified into ten genera (WoRMS 2023) and encompasses small and slender tanaidacean species known to occur in all oceans, but is best investigated in the Northeast Atlantic Basin (Bird and Holdich 1984; Guerrero-Kommritz 2005; Bamber et al. 2009; Błażewicz-Paszkowycz and Bamber 2011; Bamber 2014; Jóźwiak et al. 2018a, b). In the South Atlantic, akanthophoreid species have been described from the Southeast Atlantic (SE): Angola Basin (Guerrero-Kommritz 2004, 2005) and Subantarctic: South Georgia, South Sandwich Islands and Beagle Channel (Sieg 1986; Schmidt and Brandt 2001; Guerrero-Kommritz 2005; Błażewicz-Paszkowycz 2014), whilst the waters off the south-western Atlantic remained a blank space on the world map of akanthophoreid distribution. Recently, surveys of the benthic macrofauna of the Brazilian continental shelf and slope revealed that akanthophoreids are actually one of the five most abundant and diverse families of Tanaidacea (Lavrado et al. 2017a, b; Guimarães et al. 2020; Lavrado HP, pers. comm.).

Amongst this family, the genus *Stenotanais* Bird & Holdich, 1984 was erected by Bird & Holdich to distinguish these species from all other leptognathiid genera (as then defined) mainly by the extreme length of the pereonites 1–5, a very robust cheliped carpus and propodus with strong ventral spines and the presence of very robust uropodal setae. Currently, it is included in the family Akanthophoreidae after the Larsen and Araújo-Silva (2014) phylogenetic analysis of the group and there are four described species accommodated within the genus: *Stenotanais arenasi* Larsen, 2011; *S. crassiseta* Bird & Holdich, 1984; *S. hamicauda* Bird & Holdich, 1984; *S. macrodactylus* Larsen, 2005 (WoRMS 2023).

Amongst the akanthophoreid material obtained from the Santos Basin, off the south-eastern coast of Brazil, collect-

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ed during the Santos Project – Santos Basin Environmental Characterization (Brazil), coordinated by PETROBRAS/CENPES, was a wealth of specimens of *Stenotanais* belonging to two undescribed species. Both species are described and illustrated herein and a key to all *Stenotanais* species is provided. These two new species bring the total diversity of tanaidaceans in Brazilian waters to 66 species.

Materials and methods

Study area and collection

A total of 277 akanthophoreids was collected along the Brazilian continental margin (between 23°S and 27°S) of the SW Atlantic, during the scientific expedition Santos Project (PCR-BS) – Santos Basin Environmental Characterization (Brazil), coordinated by PETROBRAS/CENPES, in 2019 on board the R/V Ocean Stalwart. A list of the sampling stations is given in the Suppl. material 1.

Sediment samples were taken using a box corer, with three replicate samples at each station (stn) and subsequently stratified into three sediment layers, 0–2, 2–6 and 6–10 cm. Samples were washed through a 300-µm-mesh sieve. The material retained was fixed in 4% borax-buffered formalin (making molecular data unfeasible) and subsequently preserved in 70% ethanol and then tanaidaceans were sorted and identified.

Taxonomy

Selected specimens were dissected using chemically-sharpened tungsten-wire needles and appendages, mounted on slides using glycerine and then sealed. Careful examination and drawings of external morphology of the studied material was performed using a microscope Zeiss, equipped with a camera lucida and then digitalised with WACOM Tablet using the graphic programme Adobe Illustrator CC 2017 for producing taxonomic plates. The morphological terminology follows the literature related to the family Akanthophoreidae (Bird and Holdich 1984; Larsen 2003, 2005, 2011; Guerrero-Kommritz and Brandt 2005). The term "neuter" was used for post-manca stages that are not immediately categorisable as females or sub-adult (preparatory) males, although the majority are probably non-ovigerous females (Bird 2004). All setae are simple unless stated otherwise and the term 'PSS' is used for 'pinnate sensory setae' and 'L:W' for 'length to width ratio/as long as wide'. 'Spine' is used as a descriptor of stout or rigid setae (i.e. in its correct etymological sense) and the two are homologous in general structure/development.

Total body length (TBL) was measured from the tip of the rostrum to the tip of the pleotelson and pereonite width at the broadest part on whole specimens. The length/width ratio was calculated from the measurement made at mid-length and width of an article. To simplify species descriptions, the expression 'Nx' replaces 'N times as long as'. The diagnostic characters to distinguish between species are given in Table 1.

Holotypes were chosen from the best-preserved individuals. The type-material is deposited at Museu de Zoologia, Universidade de São Paulo (MZUSP) (São Paulo, Brazil).

Results

Systematics

Order Tanaidacea Dana, 1849
Suborder Tanaidomorpha Sieg, 1980
Superfamily Paratanaoidea Lang, 1949
Family Akanthophoreidae Sieg, 1986

Genus *Stenotanais* Bird & Holdich, 1984

Diagnosis (Modified from Larsen 2005, 2011). Female. Body elongate (11.5–13× L:W). Pereonites longer than wide, with straight lateral edges. Pleon short (15–20% of TBL). Antennule shorter than carapace, four-articled. Antenna six-articled. Mandibular molar tapering, with terminal spines. Maxillule with eight to ten terminal spines. Maxilliped endite with rounded cusps, spiniform lateral corners and distal seta. Cheliped carpus robust with large distoventral shield; chela robust, fixed finger with two robust ventral spines. Pereopods 1–3 basis wider than on pereopods 4–6; merus and carpus with spine. Pereopods 4–6 without coxae. Pereopods 4–6 dactylus and unguis not fused; dactylus with double-row of small spines. Pleopods short and broad, with plumose or simple setae. Uropods prominent, often as long as antennae: endopod two-articled; exopod one- or two-articled; specialised setae with a wide and flat basis present on either exopod or endopod.

Male. Immature (preparatory) male with antennule thicker than in female, functional mouthparts present (see remarks on genus). Sexually mature 'swimming' type: cephalothorax as long as first three pereonites; pereon shorter than in female; pleon well developed, as long as pereon, caudally pointed; multi-articulate antennule with multiple aesthetascs, distal article longer than preceding article; no functional mouthparts; uropod biramous, endopod and exopod two-articled.

Type species. *Stenotanais crassiseta* Bird & Holdich, 1984, by original designation. Gender: feminine.

Species included. *Stenotanais arenasi* Larsen, 2011; *S. crassiseta* Bird & Holdich, 1984; *S. hamicauda* Bird & Holdich, 1984; *S. macrodactylus* Larsen, 2005; *S. leonardoi* sp. nov.; *S. uropedon* sp. nov.

Remarks. The rather infrequently-recorded *Stenotanais* is similar to akanthophoreid genera such as *Pseudakanthophoreus* Lubinevsky, Tom & Bird, 2022 and *Parakanthophoreus* Larsen & Araújo-Silva, 2014, by having chelipeds without extensive surface ornamentation and the absence of spurs on pleonite-5, pleotelson and the uropod basal article or endopod article-1. However, *Stenotanais* can be distinguished mainly by having the basis of pereopods 1–3 thicker than the basis of pereopods 4–6

Table 1. Diagnostic characters of *Stenotanais* species. Abbreviations: A1 = antennule; Car. = carpus; Che. = cheliped; Endo. = endopod; Exo. = exopod; Mer. = merus; P = pereopod; Prop. = propodus; Uro. = uropod.

Species	*Stenotanais leonardoi* sp. nov.	*S. uropedon* sp. nov.	*S. arenasi* Larsen, 2011	*S. crassiseta* Bird & Holdich, 1984	*S. hamicauda* Bird & Holdich, 1984	*S. macrodactylus* Larsen, 2005
Type locality	Brazil (SW Atlantic)	Brazil (SW Atlantic)	Manganese Nodule Province (Central Pacific)	Rockall Trough (NE Atlantic)	Feni Ridge (NE Atlantic)	Gulf of Mexico (NW Atlantic)
Depth (m)	686–2410	991–1974	4954	2070–2916	1600–4829	1320–2387
Holotype sex	female	female	male	female	female	female
A1 length/ cephalothorax length	0.6×	0.6×	0.7×	0.6×	0.6×	0.8×
Che. basis (L:W)	3.6×	3.9×	2.4×	2.9×	3.8×	2.5×
Che. carpal shield	present	present	absent	present	present	present
Che. fixed finger, cutting edge setation	two simple setae	two simple setae and one spine	three robust setae	three simple setae	three simple setae	two robust setae
P1–6 mer. and carp. ventral spines type	simple spines	serrate spines	simple spines (= spiniform setae)	simple spines	simple spines	simple and bi-serrate (P5) spines
P2–3 carp. spine length/ prop. length	long spine (longer than half)	long spine (longer than half)	long spine (longer than half)	short spine (about one third)	long spine (about half)	long spine (P2: longer than half; P3: about half)
P2–3 prop. inferior margin	convex	convex	straight	convex	convex	straight
P2–3 prop. ventral setation	spine, microtrichia and spinules	spine, microtrichia and spinules	spine (= spiniform seta) and setules (= microtrichia)	spine and spinules	spine and spinules	spine
P1 dactylus length/ unguis length	1.0×	1.3×	0.9×	0.8×	0.9×	1.3×
P2 dactylus length/ unguis length	0.7×	1.1×	0.9×	0.8×	0.9×	> 2.0×
P3 dactylus length/ unguis length	-	1.4×	0.7×	0.9×	1.0×	1.4×
P4–6 carp. bone-shaped seta	absent	absent	present	absent	absent	absent
Uro. basis length/ pleotelson length	longer than (1.1×)	shorter than (0.6×)	shorter than (0.5×)	shorter than (Bird and Holdich (1984) text)	shorter than (0.4×)	longer than (1.4×)
Uro. exo. length/ endo. article-1 length	longer than (1.8×)	as long as	shorter than (0.8×)	as long as	longer than (1.7×)	longer than (2.2×)
Uro. exo. length/ endo. length	long, 0.7×	short, 0.3×	short, 0.4×	short, 0.4×	long, about 0.8×	long, about 0.8×
Uro. endo. shape	subparallel margins	oar-shaped (article-2 broad and flattened)	subparallel margins	subparallel margins	subparallel margins	subparallel margins
Uro. exo. shape	somewhat wider than endopod	subparallel margins	subparallel margins	subparallel margins	oar-shaped (broader distally)	subparallel margins
Uro. endo. seta type	simple setae	simple setae	simple setae	one flat and wide distal seta	one flat and wide distal seta	simple setae
Uro. exo. seta type	two flat and wide distal setae	two flat and wide distal setae	one specialised distal seta with flat and wide basis	simple setae	simple setae	one flat and wide medial seta and two articulated wide distal setae

and the presence of specialised setae with a wide and flat basal attachment on the uropod (Bird and Holdich 1984; Larsen 2011).

Larsen (2011) described *S. arenasi*, based on a single specimen and expressed uncertainty as to whether it really belongs to *Stenotanais*, so that its generic affiliation should be considered tentative. We agree that this species may belong to a different genus as its cheliped lacks a strong carpal shield, the shape of the antennule articles 3–4 does not conform to other *Stenotanais* species (article-3 not rectangular and article-4 minute, as long as wide; which can be a sexually dimorphic character) and the uropods are not ventrally deflexed (i.e. not folded back on themselves). Although not an impediment for supporting the exclusion of *S. arenasi* from *Stenotanais*, it is of note that it is so far the only species of the genus reported from the Pacific Ocean (Fig. 8). Despite these considerations, we adhere to the current classification until more evidence is available.

The single available specimen of *S. arenasi* may be a preparatory male, based on characters of the antennule articles 1–2 (as suggested by Larsen 2011) and has functional mouthparts. Here, we record the first sexually mature 'swimming' male of *S. leonardoi* sp. nov. (see below), the first to have been noticed in *Stenotanais*, although it would have been desirable to confirm the link between male and female forms of the same species using molecular analysis.

Another character in the original generic diagnosis of Bird and Holdich (1984) is the pereopods 1–3 propodus having a distinct convex inferior margin armed with small strong spinules. This needs further investigation as it is true for *S. crassiseta*, *S. hamicauda* and both new species described here, but not for *S. arenasi* and *S. macrodactylus*.

Stenotanais leonardoi sp. nov.

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Figs 1–4

Material examined. ***Holotype*:** Brazil – Santa Catarina State • neuter, length 1.9 mm; stn A8 R2, 0–2 cm; MZUSP 43545.

***Paratypes*:** Brazil – São Paulo State • 1 neuter (dissected), length 2.1 mm; stn E8 R3, 5–10 cm; MZUSP 43547 – Santa Catarina State• 1 male, length 0.9 mm; stn A8 R3, 2–5 cm; MZUSP 43546 • 3 neuters; stn A8 R1, 2–5 cm (1 dissected); MZUSP 43548 • 2 neuters; stn A8 R2, 2–5 cm; MZUSP 43549 • 2 neuters; stn A8 R3, 0–2 cm; MZUSP 43550 • 1 neuter; stn A10 R2, 2–5 cm; MZUSP 43551 • 1 neuter; stn A11 R3, 0–2 cm; MZUSP 43552 – Paraná State • 1 neuter; stn B7 R1, 0–2 cm; MZUSP 43553 • 2 neuters; stn B7 R2, 2–5 cm; MZUSP 43554 • 1 neuter; stn B7 R3, 2–5 cm; MZUSP 43555 • 1 neuter; stn B8 R2, 2–5 cm; MZUSP 43556 • 1 neuter; stn B9 R2, 5–10 cm; MZUSP 43557 – São Paulo State • 2 neuters; stn C7 R1, 2–5 cm; MZUSP 43558 • 1 neuter; stn C7 R2, 2–5 cm; MZUSP 43559 • 1 neuter; stn C7 R3, 2–5 cm; MZUSP 43560 • 1 neuter; stn C7 R3, 5–10 cm; MZUSP 43561 • 1 neuter; stn C8 R1, 2–5 cm; MZUSP 43562 • 2 neuters and 1 juvenile; stn C8 R2, 2–5 cm; MZUSP 43563 • 2 neuters; stn C9 R1, 2–5 cm; MZUSP 43564 • 1 neuter; stn C9 R1, 5–10 cm; MZUSP 43565 • 1 neuter; stn C11 R1, 2–5 cm; MZUSP 43566 • 1 neuter; stn C11 R2, 2–5 cm; MZUSP 43567 • 1 neuter; stn D8 R1, 0–2 cm; MZUSP 43568 • 2 neuters; stn E7 R3, 2–5 cm; MZUSP 43569 • 1 neuter; stn E8 R1, 5–10 cm; MZUSP 43570 • 2 neuters; stn E8 R3, 2–5 cm; MZUSP 43571 • 2 neuters; stn E9 R1, 5–10 cm; MZUSP 43572 – Rio de Janeiro State • 1 neuter; stn F7 R1, 2–5 cm; MZUSP 43573 • 1 neuter; stn F7 R2, 2–5 cm; MZUSP 43574 • 1 neuter; stn F7 R2, 5–10 cm; MZUSP 43575 • 1 neuter; stn F7 R3, 2–5 cm; MZUSP 43576 • 1 neuter; stn H7 R2, 2–5 cm; MZUSP 43577 • 1 neuter; stn H10 R2, 2–5 cm; MZUSP 43578 • 1 neuter; stn H10 R2, 5–10 cm; MZUSP 43579 • 1 neuter; stn P5 R3, 2–5 cm; MZUSP 43580.

Diagnosis. Neuter. Cheliped fixed finger with two simple setae on cutting edge. Pereopods 2–3 carpus with long spine, longer than half length of propodus. Uropod basal article longer than pleotelson; exopod and endopod with subparallel margins; exopod slightly wider than endopod, longer than endopod article-1 (0.7× endopod), with two flat and wide terminal setae.

Etymology. The species is dedicated to the first author's life partner, Leonardo Santos de Souza, who has supported and encouraged this author in her academic career.

Description. Based on neuter holotype (MZUSP 43545) length 1.9 mm, dissected neuter paratype (MZUSP 43547) length 2.1 mm and male (MZUSP 43546) length 0.9 mm. Body (Fig. 1A) very slender, about 14× L:W. Cephalothorax elongate 1.7× L:W, 1.5× pereonite-1, straight-sided, naked. Pereonites 1–6. All pereonites rectangular, longer than wide, parallel-sided; pereonite-1 1.3× L:W; pereonite-2 2.3× L:W; pereonite-3 2.4× L:W; pereonites 4–5 2.0× L:W; pereonite-6 shortest, 1.3× L:W. Pleon (Fig. 1A) short, 0.2× TBL, about as long as pereonites 5 and 6 combined, with five subequal pleonites. Pleotelson short, trapezoidal 0.6× L:W, less than half-length of pleon.

Antennule (Fig. 2A) 0.6× cephalothorax; article-1 about 0.4× TL, 1.6× L:W, with one simple seta and three distal PSS; article-2 1.8× L:W, 0.8× article-1, with two simple setae and one distal PSS; article-3 0.9× L:W, 0.3× article-2, with simple subdistal seta; article-4 2.6× L:W, 1.9× article-3, with simple subdistal seta and with aesthetasc, three simple and minute terminal setae. Antenna (Fig. 2B) article-1 fused with body; article-2 as long as wide, with one simple distal seta; article-3 1.5× L:W, naked; article-4 2.8× L:W, 2.2× article-3, with three medial PSS and three simple distal setae; article-5 3.0× L:W, 0.7× article-4, with a distal seta; article-6 minute with five simple terminal setae.

Labrum (Fig. 2C) elongate, hood-shaped, covered by minute setae. Mandible (Fig. 2D–G) with acuminate molar process with three or four terminal spines; left mandible (Fig. 2D, E) incisor smooth, with five unequal teeth and smooth lacinia mobilis (separated from incisor by wide gap); right mandible (Fig. 2F, G) with three strong teeth on incisor process, molar broken off during dissection. Maxillule (Fig. 2H) endite with nine terminal spines (at least two serrate), outer margin with setule; palp broken off during dissection. Maxilla (Fig. 2I) ovoid and stout, but large relative to maxilliped.

Maxilliped (Fig. 2J) basis with one simple seta near articulation with palps, not reaching distal margin of endites; endites unfused, with rounded distal cusps and a short seta on distal edge; palp article-1 naked; article-2 with three inner and one outer setae; article-3 with three (two long) inner setae; article-4 with four inner setae and one subdistal outer seta. Labium and epignath not observed.

Cheliped (Fig. 2K) and sclerite calcified; basis with one minute dorsodistal seta and long posterior projection (lobe), not reaching pereonite-1; 3.6× L:W; merus subtriangular, with ventral seta; carpus stout 1.4× L:W, with ventral seta and one proximal and one dorsodistal setae, carpal shield large, well developed; propodus stout 0.9× carpus, 1.5× L:W, with two setae near dactylus insertion on inner side (one long and one short); fixed finger with two strong serrate ventral spines and one spine on distolateral margin; cutting edge with two simple setae, dactylus slightly shorter than fixed finger.

Pereopod-1 (Fig. 3A) stout; coxa annular, seta not observed; basis broad 2.2× L:W, naked; ischium with seta (not drawn); merus short 0.8× L:W, with one ventrodistal seta and long spine reaching carpus distal margin; carpus short 0.6× L:W, about as long as merus, with ventrodistal spine and one spinule (microtrichial), dorsodistal with long spine and microtrichia; propodus short 1.9× L:W, 2.3× carpus, with convex inferior margin with ventrodistal spine, microtrichia and two spinules and dorsodistal minute seta; dactylus as long as unguis, together 0.8× propodus.

Pereopod-2 (Fig. 3B) stout; basis broad 2.0× L:W, with large dorsal PSS; ischium with one seta; merus 1.1× L:W, with ventrodistal long spine reaching carpus distal margin; carpus short as long as wide, as long as merus, with ventral spinules and microtrichia, two unequal ventrodistal spines (one longer than half length of propodus) and dorsodistal spine; propodus short 2.0× L:W, 1.7× carpus, with convex inferior margin with ventrodistal spine,

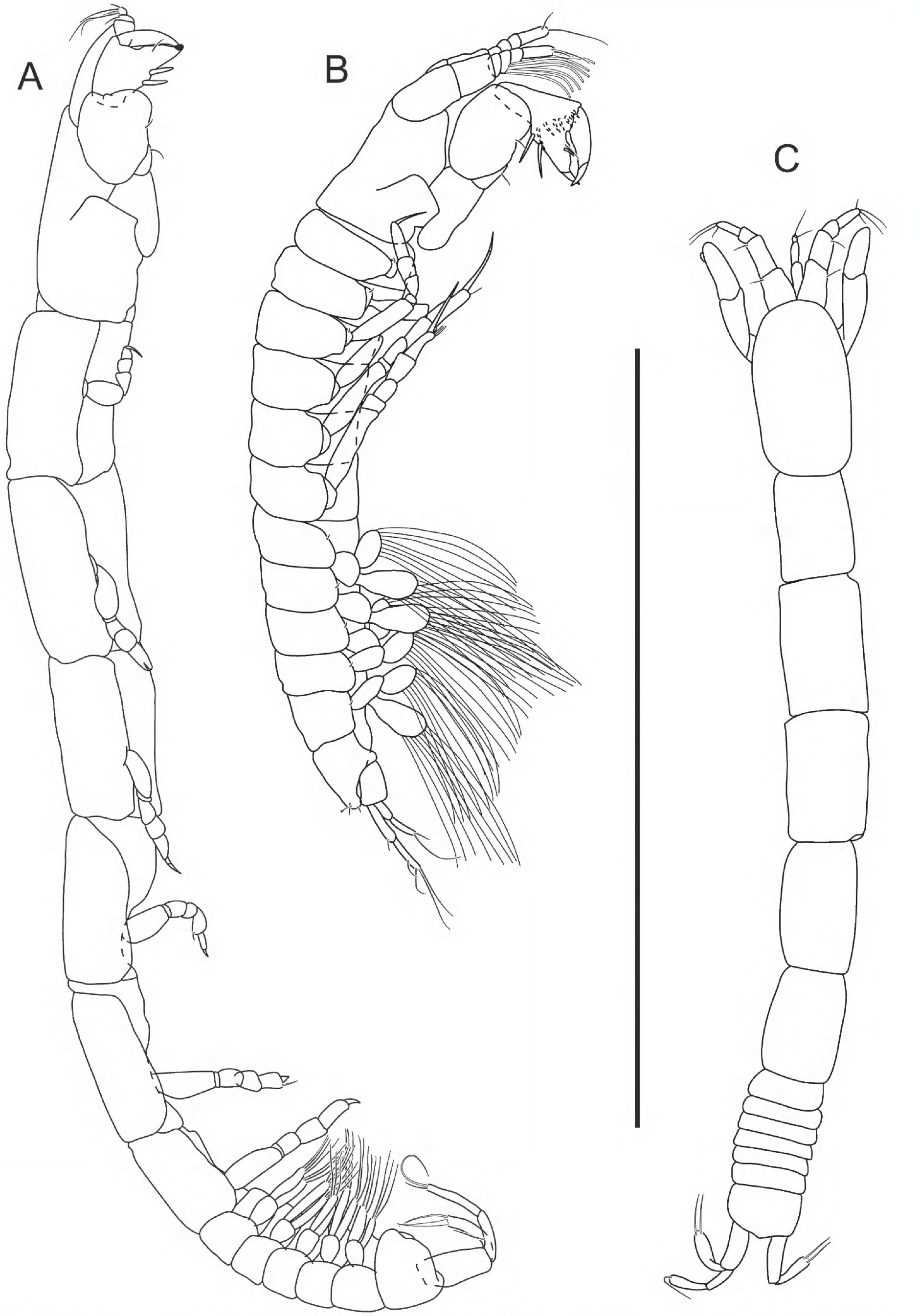

Figure 1. *Stenotanais leonardoi* sp. nov. **A.** Holotype, neuter (MZUSP 43545), lateral view; **B.** Paratype, male (MZUSP 43546), lateral view; **C.** Paratype, juvenile (MZUSP 43563), dorsal view. Scale bars: 1.0 mm.

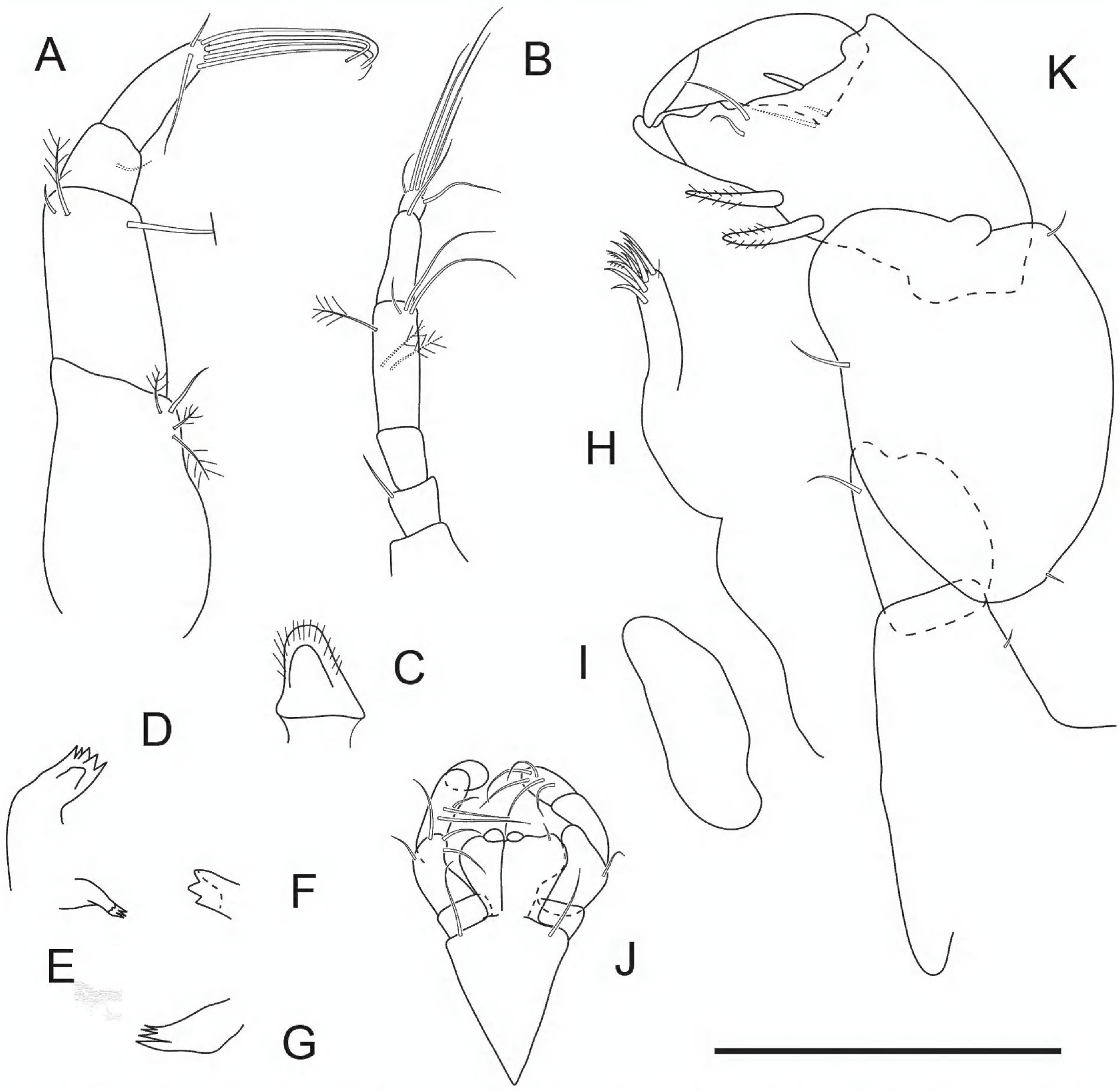

Figure 2. *Stenotanais leonardoi* sp. nov. Paratype, neuter dissected (MZUSP 43547). **A.** Antennule; **B.** Antenna; **C.** Labrum; **D.** Left mandible (incisor); **E.** Left mandible (molar); **F.** Right mandible (incisor); **G.** Right mandible (molar); **H.** Maxillule; **I.** Maxilla; **J.** Maxilliped; **K.** Cheliped. Scale bars: 0.1 mm.

microtrichia and two spinules, dorsodistal minute seta; dactylus 0.7× unguis, together 0.8× propodus.

Pereopod-3 (Fig. 3C) similar to pereopod-2, except basis naked.

Pereopod-4 (Fig. 3D) basis broken during dissection, naked; ischium with two long seta (only one drawn); merus 1.2× L:W, with two ventrodistal spines; carpus 1.6× L:W, with one seta and three distal spines; propodus stout 2.8× L:W, with two ventrodistal spines and robust dorsodistal seta; dactylus with double row of ventral spines, 1.9× unguis, together as long as propodus.

Pereopod-5 (Fig. 3E) similar to pereopod-4, except basis 2.4× L:W; 2.3× L:W, with dorsodistal minute and robust setae; dactylus and unguis together 1.2× propodus.

Pereopod-6 (Fig. 3F) similar to pereopod-5, except basis 1.9× L:W; ischium with two long seta (only one drawn); propodus short 1.6× L:W, with three robust dorsodistal setae (one long and two short); dactylus with larger ventral spines, 3.2× unguis, together 0.9× propodus.

Pleopod (Fig. 3G) basal article naked; exopod with at least four plumose setae on outer margin and one seta on inner margin; endopod with at least ten plumose setae on outer margin, large gap between most proximal.

Uropod (Fig. 3H) reflexed; basis long 2.3× L:W, about 1.1× pleotelson, naked; exopod (Fig. 3H") one-articled, somewhat wider than endopod, 0.7× endopod, with long medial seta and tipped by two specialised stout setae; endopod (Fig. 3H') two-articled; article-1 with distal seta; article-2 with long medial seta, two PSS and two simple distal setae.

Male (Figs 1B, 4A–C). The only specimen of a putative 'swimming male' of this species has a pereon short-

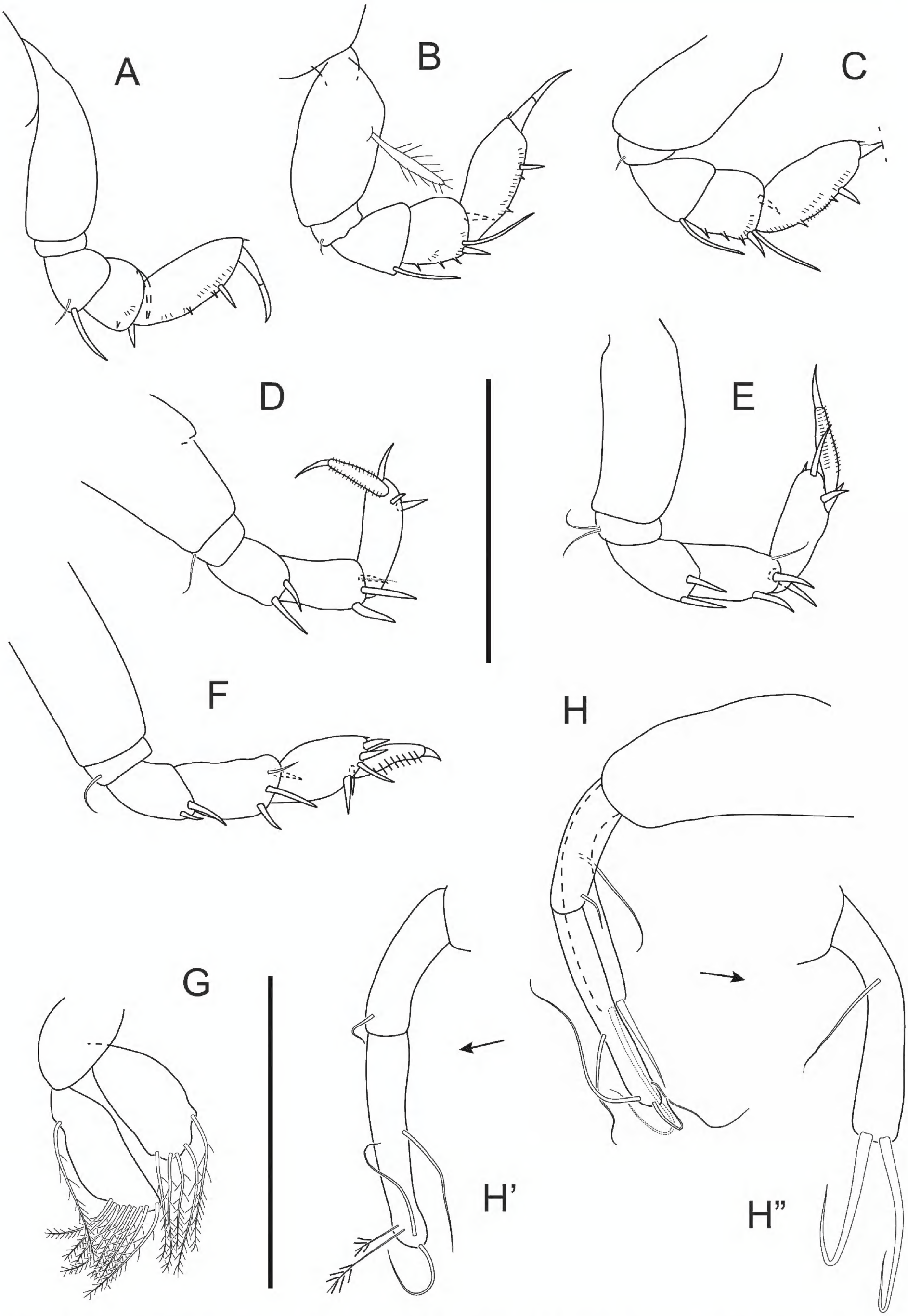

Figure 3. *Stenotanais leonardoi* sp. nov. Paratype, neuter dissected (MZUSP 43547). **A–F.** Pereopods 1–6; **G.** Pleopod; **H.** Uropod; **H'.** Uropod endopod; **H".** Uropod exopod. Scale bar: 0.1 mm.

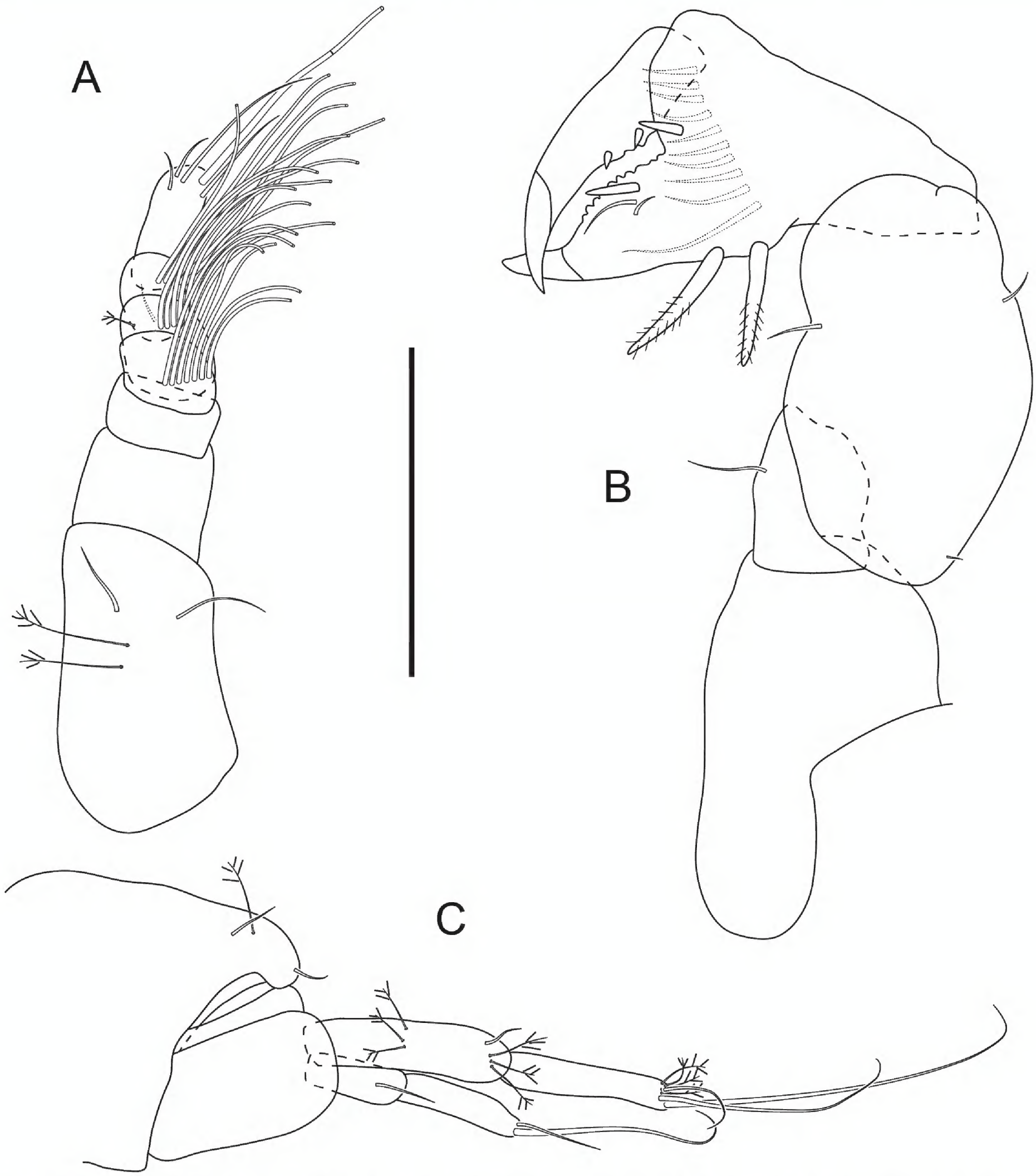

Figure 4. *Stenotanais leonardoi* sp. nov. Paratype, male (MZUSP 43546). **A.** Antennule; **B.** Cheliped; **C.** Uropod. Scale bar: 0.1 mm.

er than in female and a well-developed pleon (Fig. 1B), larger than in female, as long as the pereon. Antennule seven-articled (Fig. 4A), broader than female, with numerous aesthetascs. No functional mouthparts. Cheliped thinner than in female (Fig. 4B), propodus fixed finger and dactylus with sharp point. Pleopods strong, supported with long plumose setae (with more setae than female). Uropod biramous (Fig. 4C), endopod and exopod of two articles.

Type locality. Santa Catarina State, Brazil; stn A8 R2, -27,29679714, -46,62516071 (1045 m).

Distribution. Brazil: Santos Basin (Rio de Janeiro, São Paulo, Paraná and Santa Catarina States). Occurring on the lower slope and the São Paulo Plateau area, ranging from depths of 686 to 2410 m. This species was the most abundant (51 individuals), with 71% of the specimens found at 2–5 cm sediment layer (i.e. up to 25× their body length).

Remarks. This new species is similar to *S. crassiseta* from the NE Atlantic in having the propodus of pereopods 1–3 with a convex inferior margin bearing many spinules and the general shape of the uropod endopod, but is distinguished by: (1) the cheliped basis more slender 3.6× L:W (2.9× in *S. crassiseta*); (2) the cheliped fixed finger with two simple setae on cutting edge (three in *S. crassiseta*); (3) the pereopod-1 dactylus as long as

unguis (0.8× in *S. crassiseta*); (4) the pereopods 2–3 carpus with long spine, longer than half length of propodus (about one third in *S. crassiseta*); and (5) the uropod exopod one-articled and much longer than endopod article-1, 0.7× endopod (exopod two-articled and as long as endopod article-1, 0.4× in *S. crassiseta*).

Stenotanais leonardoi sp. nov. also resembles *S. macrodactylus* from the Gulf of Mexico (NW Atlantic) mainly by the shape of uropod; however, it differs by a combination of characters including: (1) antennule 0.6× cephalothorax (slightly shorter 0.8× in *S. macrodactylus*); (2) cheliped fixed finger with two simple setae on cutting edge (two 'spiniform setae' in *S. macrodactylus*); (3) pereopod-2 dactylus 0.7× unguis (more than twice in *S. macrodactylus*); and (4) pereopods 2–3 propodus with convex inferior margin with ventrodistal spine, microtrichia and spinules (only with ventrodistal spine in *S. macrodactylus*). The new species has the cheliped fixed finger with strong serrate spines ventrally, which could have been overlooked by other authors (e.g. as 'strong spines', Bird and Holdich (1984) or as 'robust spiniform setae', Larsen (2005, 2011)).

The male is of the 'swimming' type with no functional mouthparts, shortened pereon and multi-articulate antennule with multiple aesthetascs. This specimen was found in the same sample as an individual of *S. leonardoi* (a neuter) and was identified as this species by chelipedal features, such as the basis with a long posterior lobe, a carpal shield and well-developed fixed finger with two strong serrate ventral spines and uropod rami with subparallel margins (not oar-shaped as in *S. uropedon* sp. nov.). Only one male specimen was sampled while 50 neuters were collected, demonstrating how "unbalanced" the sexual ratio can be in tanaidacean species. However, as with all 'swimming males' and the rare matching of sexes, only with a molecular analysis can conspecificity be absolutely confirmed (Błażewicz-Paszkowycz et al. 2014).

Stenotanais uropedon sp. nov.

https://zoobank.org/0EA50F8D-E7F1-434D-A5A1-ED2E28B86E43

Figs 5–7

Material examined. ***Holotype*:** Brazil – São Paulo State • neuter, length 1.7 mm; stn D10 R3, 5–10 cm; MZUSP 43581.

***Paratypes*:** Brazil – Rio de Janeiro State • 1 neuter (dissected), length 1.7 mm; stn P10 R3, 5–10 cm; MZUSP 43582 – Santa Catarina State • 1 neuter; stn A8 R1, 0–2 cm; MZUSP 43583 – Paraná State • 1 neuter; stn B9 R1, 5–10 cm; MZUSP 43584 • 1 neuter; stn B9 R3, 5–10 cm; MZUSP 43585 – São Paulo State • 1 neuter; stn C8 R1, 2–5 cm (dissected); MZUSP 43586 • 1 neuter; stn E8 R1, 0–2 cm; MZUSP 43587 • 1 neuter; stn E8 R3, 2–5 cm; MZUSP 43588 • 1 neuter; stn E10 R2, 2–5 cm; MZUSP 43589 • 1 neuter; stn E10 R3, 5–10 cm; MZUSP 43590. – Rio de Janeiro State • 1 juvenile; stn F8 R2, 0–2 cm; MZUSP 43591 • 1 neuter; stn F8 R2, 2–5 cm; MZUSP 43592 • 1 neuter; stn F9 R3, 2–5 cm; MZUSP 43593 • 2 neuters; stn G9 R1, 0–2 cm; MZUSP 43594 • 1 juvenile; stn P3 R2, 2–5 cm; MZUSP 43595.

Diagnosis. Neuter. Cheliped fixed finger with two simple setae and one spine on cutting edge and a nearby spine on the distolateral margin of the propodal palm. Pereopods 2–3 carpus with long spine, longer than half length of propodus. Uropod endopod oar-shaped, with article-2 broad and flattened; exopod short, 0.3× of endopod length; both rami without specialised articulated setae.

Etymology. From the Greek 'pedon' (noun), meaning 'oar, rudder'; alluding to the shape of uropod endopod. The name is a noun in apposition with the generic name.

Description. Based on neuter holotype (MZUSP 43581) length 1.7 mm and dissected neuter paratype (MZUSP 43582) length 1.7 mm. Body (Fig. 5A) slender, about 8.5× L:W. Cephalothorax elongate 1.7× L:W, 1.7× pereonite-1, straight-sided, naked. Pereonites 1–6. All pereonites rectangular, parallel-sided; pereonite-1 0.8× L:W; pereonite-2 1.3× L:W; pereonites 3–4 1.2× L:W; pereonite-5 square, as long as wide; pereonite-6 shortest, 0.5× L:W. Pleon (Fig. 5A, B) short, 0.1× TBL, about as long as pereonites 5 and 6 combined, with five subequal pleonites, with one minute seta on lateral margins. Pleotelson (Fig. 5B) trapezoidal about 0.7× L:W, 0.4× pleon, with pointed posterior margin bearing two pairs of simple setae and one of PSS distally.

Antennule (Fig. 5C) 0.6× cephalothorax; article-1 0.5× TL, 1.9× L:W, with three middle PSS and one simple and two PSS distally; article-2 1.6× L:W, 0.6× article-1, with two simple (one long and one minute) and two distal PSS; article-3 1.1× L:W, 0.5× article-2, with simple subdistal seta; article-4 2.4× L:W, 1.5× article-3, with aesthetasc and six simple terminal setae. Antenna (Fig. 5D) article-1 fused with body; article-2 0.8× L:W, with one simple distal seta; article-3 1.3× L:W, naked; article-4 2.7× L:W, 1.9× article-3, with one simple medial seta and three simple setae and two distal PSS; article-5 3.0× L:W, 0.7× article-4, with one distal seta; article-6 minute with five simple terminal setae.

Labrum (Fig. 5E) large, hood-shaped, covered by minute setae on lateral and distal margins. Mandible (Figs. 5F, G) broken during dissection; left mandible (Fig. 5F) with incisor smooth; right mandible (Fig. 5G) with at least two teeth on incisor process, molar broken off during dissection. Maxillule (Fig. 5H) endite with eight terminal spines (at least two serrate), outer margin with setules; palp broken off during dissection. Maxilla (Fig. 5I) ovoid and stout, with one side wider, but large relative to maxilliped. Labium (Fig. 5J) with distal corner finely setose.

Maxilliped (Fig. 6A) basis with simple seta near articulation with palps, not reaching distal margin of endites; endites unfused, divided into three lobe-like structures, with one seta on distal edge; palp article-1 naked; article-2 with three inner (at least one serrate) and one outer setae; article-3 with three (two long, at least one serrate) inner setae; article-4 with four inner setae and one subdistal outer seta. Epignath not observed.

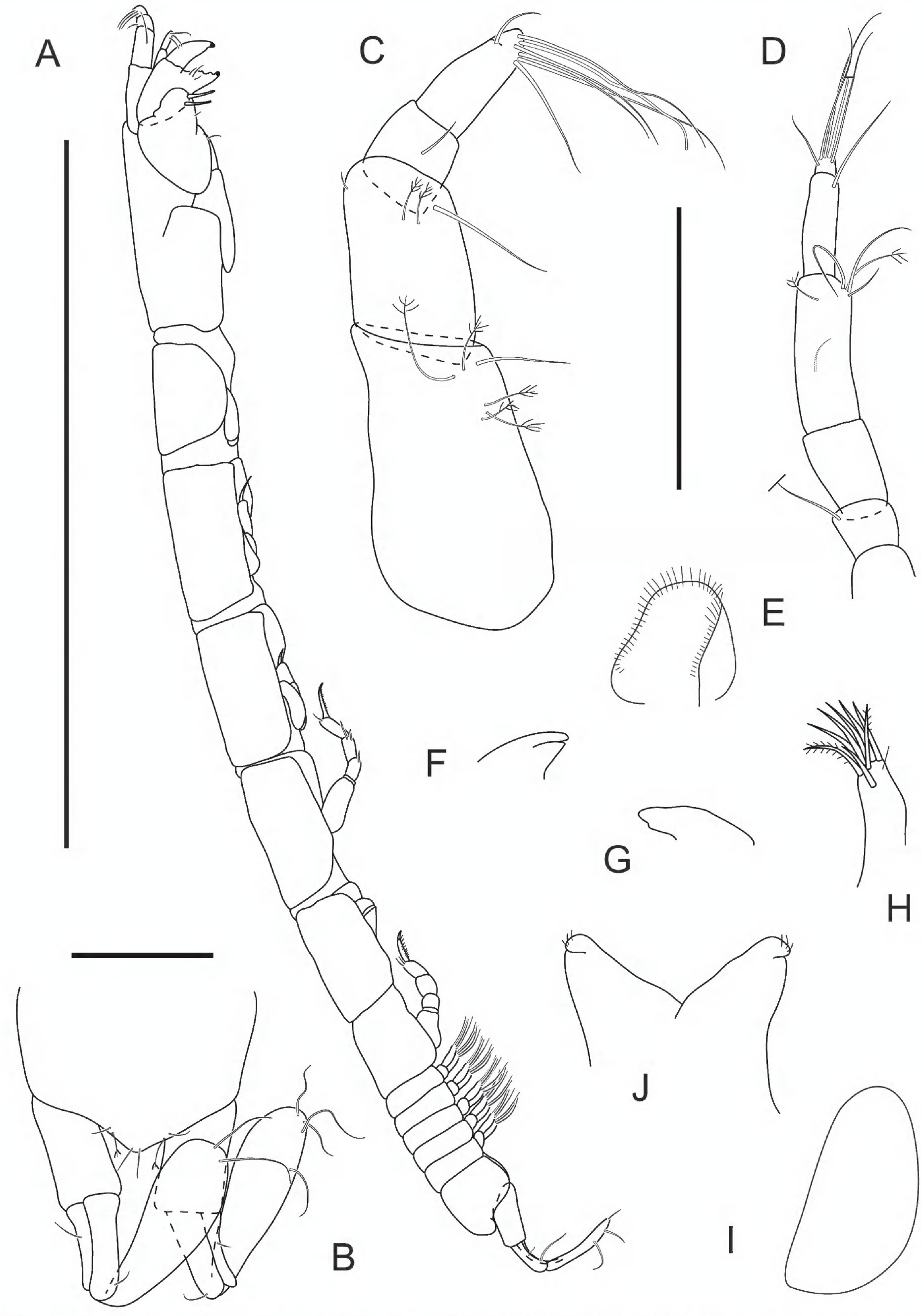

Figure 5. *Stenotanais uropedon* sp. nov. **A.** Holotype, neuter (MZUSP 43581), lateral view; **B.** Pleotelson and uropods, dorsal view; **C.** Antennule; **D.** Antenna; **E.** Labrum; **F.** Left mandible (incisor); **G.** Right mandible (incisor); **H.** Maxillule; **I.** Maxilla; **J.** Labium. Scale bars: 1.0 mm (**A**); 0.1 mm (**B–J**).

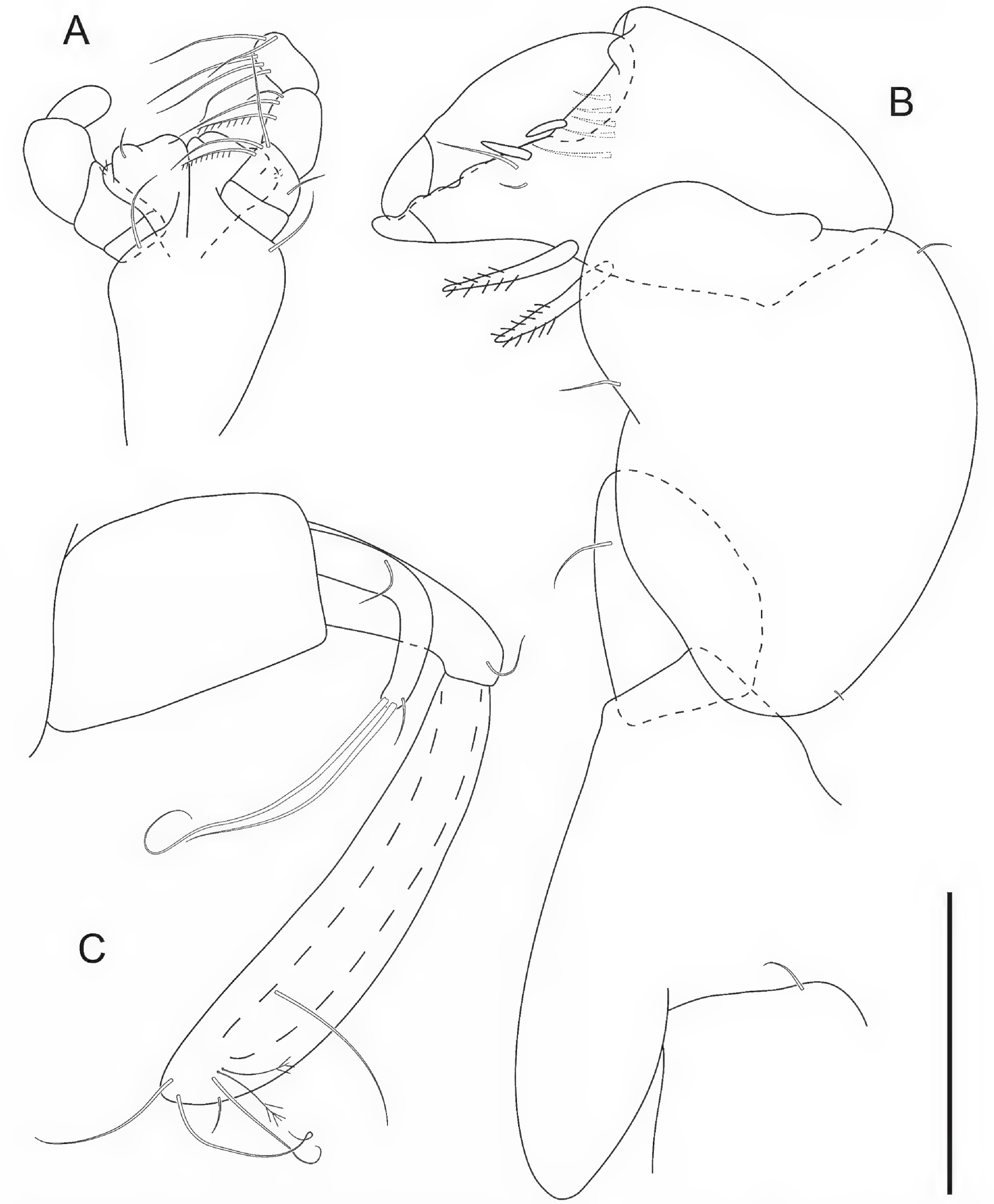

Figure 6. *Stenotanais uropedon* sp. nov. Paratype, neuter dissected (MZUSP 43582). **A.** Maxilliped; **B.** Cheliped; **C.** Uropod. Scale bars: 0.1 mm.

Cheliped (Fig. 6B) calcified; basis attached to cephalothorax by large sclerite with dorsodistal setae; basis with long posterior lobe, not reaching pereonite-1, 3.9× L:W; merus subtriangular, with one ventral seta; carpus stout 1.4× L:W, with one ventral seta and one proximal and one dorsodistal setae, carpal shield well developed; propodus stout 0.9× carpus, 1.6× L:W, with an outer spine and five setae near dactylus insertion on inner side; fixed finger with two strong serrate spines ventrally; cutting edge with two simple setae and one spine; dactylus slightly shorter than fixed finger.

Pereopod-1 (Fig. 7A) coxa with small seta; basis broad 1.8× L:W, naked; ischium with seta; merus 1.3× L:W, with ventrodistal seta and long serrate spine not

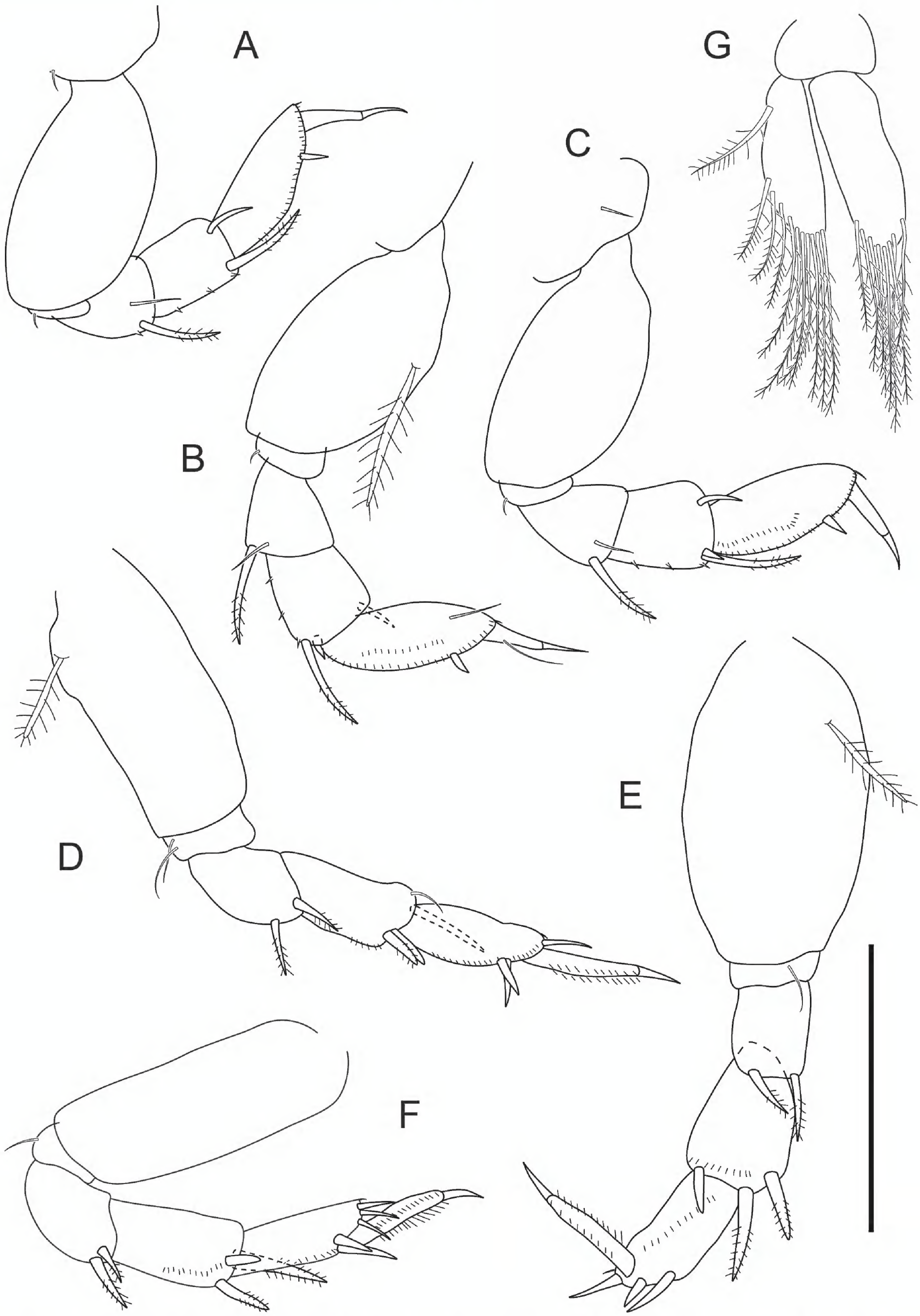

Figure 7. *Stenotanais uropedon* sp. nov. Paratype, neuter dissected (MZUSP 43582). **A–F.** Pereopods 1–6; **G.** Pleopod. Scale bars: 0.1 mm.

reaching carpus distal margin; carpus 1.2× L:W, about as long as merus, with ventrodistal long serrate spine, dorsodistal spine and ventral spinules; propodus 2.2× L:W, 1.6× carpus, with convex inferior margin with ventrodistal spine and microtrichia, one dorsodistal minute seta; dactylus 1.3× unguis; together 0.8× propodus.

Pereopod-2 (Fig. 7B) coxa with a small seta (not drawn); basis broad 1.7× L:W, with large dorsal PSS; ischium with one seta; merus 1.1× L:W, with a ventrodistal seta and long serrate spine almost reaching carpus distal margin; carpus about as long as wide, about as long as merus, with ventral spinules, two unequal ventrodistal spines (one about half length of propodus) and dorsodistal spine; propodus 2.1× L:W, 1.6× carpus, with convex inferior margin with ventrodistal spine and microtrichia, one mid-dorsal simple seta and one dorsodistal minute seta; dactylus 1.1× unguis, with one seta; together 0.7× propodus.

Pereopod-3 (Fig. 7C) similar to pereopod-2, except basis 1.9× L:W, naked; dactylus 1.4× unguis, naked.

Pereopod-4 (Fig. 7D) basis about 2.3× L:W, with large ventral PSS; ischium with two long setae; merus 1.3× L:W, with two ventrodistal serrate spines; carpus 1.8× L:W, with one seta and three (one long and two short) distal spines; propodus stout 2.4× L:W, with two ventrodistal spines and one robust and one minute dorsodistal setae; dactylus long with double row of ventral spines, 2.4× unguis, together 1.1× propodus.

Pereopod-5 (Fig. 7E) similar to pereopod-4, except basis 1.8× L:W; ischium with two long setae (only one drawn); carpus 1.2× L:W, with three distal spines; propodus 2.2× L:W.

Pereopod-6 (Fig. 7F) similar to pereopod-5, except basis 2.7× L:W, naked; merus 1.4× L:W; carpus 1.7× L:W; propodus 2.6× L:W, with three robust dorsodistal setae; dactylus with larger ventral spines, 2.6× unguis.

Pleopod (Fig. 7G) basal article naked; exopod with at least seven plumose setae on outer margin and one seta on inner margin; endopod with at least ten plumose setae and one more robust proximal seta on outer margin, large gap between most proximal.

Uropod (Fig. 6C) rami reflexed; basis 1.4× L:W, 0.6× pleotelson, naked; exopod one-articled, 0.3× endopod, with medial seta and tipped by two stout and one simple setae; endopod two-articled; article-1 with one distal seta; article-2 oar-shaped, with one long medial seta and two PSS and four simple distal setae.

Type locality. São Paulo State, Brazil; stn D10 R3, -25,94725395, -44,83425777 (1906 m).

Distribution. Brazil: Santos Basin (Rio de Janeiro, São Paulo, Paraná and Santa Catarina States). Occurring on the lower slopes and the São Paulo Plateau area, ranging from depths of 991–1974 m. Twenty-two individuals of this species were collected, with 41% of them found in the 5–10 cm sediment layer (i.e. up to 50–60× their body length) and 32% at a depth of 2–5 cm.

Remarks. This new species resembles *S. hamicauda* from the NE Atlantic by the oar-shaped uropod, but is different from it by: (1) cheliped fixed finger with two simple setae and one spine on cutting edge (three simple setae in *S. hamicauda*); (2) pereopods 1–3 dactylus 1.3× unguis (about as long as in *S. hamicauda*); (3) uropod endopod oar-shaped (in *S. hamicauda* the exopod is oar-shaped); and (4) exopod short, 0.3× endopod length (in *S. hamicauda* exopod reaching about 0.8× endopod length).

Stenotanais uropedon sp. nov. differs from *S. leonardoi* by its oar-shaped uropod endopod, with the article-2 broad and flattened (with short exopod, 0.3× endopod), whereas in *S. leonardoi*, the exopod is slightly wider than the endopod (0.7× endopod). Additionally, *S. uropedon* has pereopods with the merus and carpus having long serrate distoventral spines, which are different from those of *S. leonardoi* (with simple spines); however, these different forms could have been overlooked by previous authors in other congeneric species.

Key to the *Stenotanais* species

Modified from Larsen (2005, 2011)

1 Cheliped carpus without large ventrodistal shield ..... *S. arenasi*
– Cheliped carpus with large ventrodistal shield 2
2 Uropod exopod or endopod distinctly oar-shaped (broader distally) 3
– Uropod exopod or endopod slender/subparallel-sided 4
3 Uropod exopod oar-shaped, reaching at least to 0.75× of entire endopod length; exopod with two specialised flattened setae ..... *S. hamicauda*
– Uropod endopod oar-shaped, with article-2 broad and flattened; exopod 0.3× of entire endopod length; exopod with two flat and wide setae ..... *S. uropedon* sp. nov.
4 Uropod basal article longer than pleotelson; exopod one-articled 5
– Uropod basal article shorter than pleotelson; endopod with one flat and wide seta distally; exopod two-articled without flat and wide setae ..... *S. crassiseta*
5 Uropod exopod with one flat and wide seta at mid-length and two articulated wide terminal setae ..... *S. macrodactylus*
– Uropod exopod with two flat and wide terminal setae ..... *S. leonardoi* sp. nov.

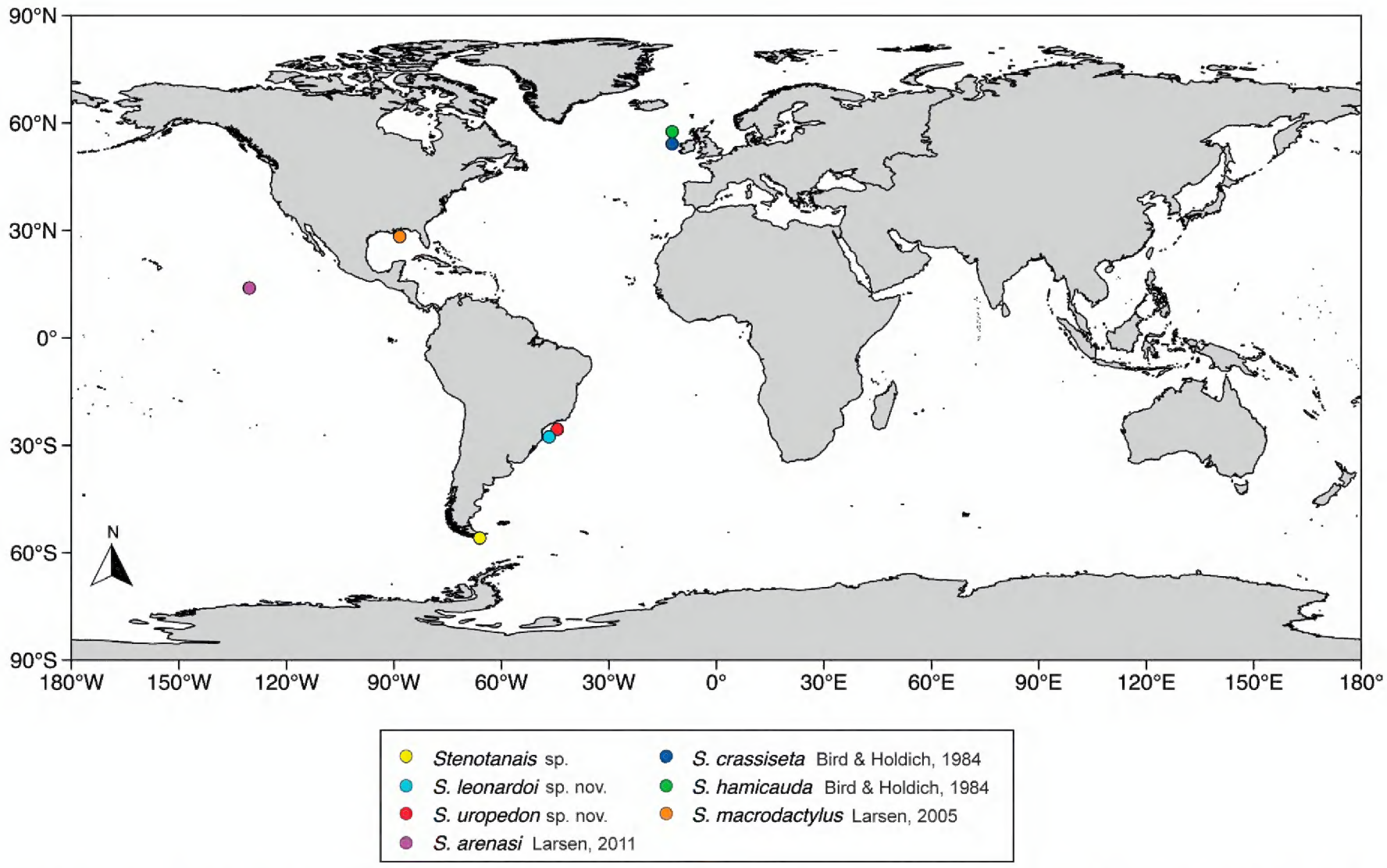

Figure 8. Geographic distribution of *Stenotanais* species based on the present study and literature data (Bird and Holdich 1984; Schmidt and Brandt 2001; Larsen 2005, 2011).

Discussion

This is the first Brazilian species described of the family Akanthophoreidae and the second record of the genus *Stenotanais* in the Southern Hemisphere. *Stenotanais* was first reported from the Southern Hemisphere on the continental slope of Magellan Region (Beagle Channel; 1279 m) (Schmidt and Brandt 2001), but the species was not identified and could not be compared to the two new species presented herein; this record was included on the distribution map of the genus as *Stenotanais* sp. (Fig. 8) for future studies to establish if this Subantarctic taxon refers to a different species. *Stenotanais* is now composed of six species, five of them distributed in the Atlantic Ocean (Fig. 8): two in the NE Atlantic – *S. crassiseta* and *S. hamicauda*, one in the NW Atlantic – *S. macrodactylus* and the two new species from Brazil, SW Atlantic. Only *S. arenasi* was recorded from the Pacific Ocean, but this classification should be further investigated (see genus remarks).

The two new deep-burrowing species of *Stenotanais* described here bring the total number of akanthophoreids to 56 species and that of all tanaidaceans in Brazilian waters to 66 species. Although many papers on Tanaidacea off Brazilian waters have been published in recent years, we are still discovering new taxa in this region, with plenty of new species to be discovered in the future. Taxonomic works from understudied areas, such as the Brazilian deep-waters, provide a basis for future studies in fields such as biogeography, ecology and evolution and, although several papers have been published in the last decade, there is still much to be investigated regarding the tanaidaceans of Brazil.

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JLS and MT contributed to designing the study; JLS received funds for this work, identified the material, worked on illustrations, prepared the tables and wrote the manuscript; GB and MT reviewed the text; GB reviewed the English language. All authors read and approved the final manuscript and consent to publication.

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Supplementary material 1

Benthic samples with *Stenotanais* specimens obtained during Santos Project (PCR-BS) – Santos Basin Environmental Characterization (Brazil).

Authors: Juliana Lopes Segadilha, Graham Bird, Marcos Tavares

Data type: Table (word file).

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